

REMARKS

Claims 1-28 and 30-33 were pending in the present application. In the Final Office Action sent September 13, 2007, the Examiner rejected claims 1-9 and 12-26 under 35 U.S.C. §102(e) as being anticipated by Larson et al. (US Pub. 2004/0155653). The Examiner next rejected claim 27 under 35 U.S.C. §103(a) as being unpatentable over Larson et al. Claims 10, 11, and 33 were rejected under 35 U.S.C. §103(a) as being unpatentable over Larson et al. in view of Haacke et al. (Haacke et al., *Magnetic Resonance Imaging*, John Wiley and Sons, 1999) (hereinafter Haacke). Claims 28 and 30-32 were rejected under U.S.C. §103(a) as being unpatentable over Larson et al. in view of Ho et al. (US Pub. 2003/0216637). The Examiner maintained the rejections in an Advisory Action sent May 30, 2008, well after the 6 month date from the Final Office Action.

Applicant is concurrently filing a Request for Continued Examination. In addition, Applicant is also concurrently filing herewith a Supplemental Information Disclosure. Claims 1-33 are hereby cancelled and claims 34-54 are newly presented herein to more clearly define the invention.

In response to the Examiner's rejections made in the Final Office Action sent September 13, 2007, and the Advisory Action sent May 30, 2008, please consider the following remarks.

Larson et al. does not expressly or inherently teach, disclose, or suggest the determination of motion from non-spatially encoded MR data as set forth in claim 34. The Examiner inaccurately stated that non-spatially encoded MR data is equivalent to non-imaging MR data. *Office Action*, 09/13/2007, pg. 2-4; *Advisory Action*, 05/30/2008, pg. 2. The Examiner has repeatedly stated that “non-imaging data ... is equivalent to non-spatially encoded data, because spatial encoding is inherently necessary in MRI in order to form an image.” *Id.* In other words, the Examiner states that since spatially encoded data is necessary to reconstruct an image, non-imaging data is equivalent to non-spatially-encoded data.

Contrary to the Examiner's assertion, all non-imaging data is not equivalent to non-spatially encoded data. Larson et al. defines “imaging data” as “data that is used to produce MR images, and not ... data that is acquired exclusively for other purposes, e.g., additional data acquired solely to provide timing information.” *Larson et al.*, ¶57. This statement, however, does not mean that non-spatially-encoded data is equivalent to non-imaging data. Larson et al. itself contains a classic example of spatially-encoded non-imaging data. *Id.* at ¶9. That is, Larson et al. discloses that “a technique known as navigator gating or navigator echo [that] derives a timing signal from extra, non-imaging data.” *Id.* (emphasis added). In support of such example,

Larson et al. cites to Ehman & Felmlee, “Adaptive technique for high-definition MRI of moving structures.” *Radiology*, 173:255-263 (1988) (hereinafter Ehman et al.). This same Ehman et al. paper referenced by Larson et al. has been submitted herewith in a supplementary Information Disclosure Statement. As clearly seen in the Ehman et al. reference, the navigator echo discussed therein is used to gather spatially-encoded non-imaging MR data – not non-spatially-encoded non-imaging data. See *Ehman et al.*, pgs. 255-263. For example, figure two of such reference clearly shows the navigator echo (NAV) being applied as the frequency spatial-encoding gradient, G_x , is applied. *Ehman et al.*, pg. 256, FIG. 2. As such, the NAV echo sequence provides “x-axis displacement information” – spatially-encoded non-imaging data. *Id* at pg. 256. This spatially-encoded information or data is then used to correct the image echo data. *Id* at pgs. 256-257. That is, Ehman et al. discloses the use of spatially-encoded non-imaging data to correct imaging data. Ehman et al. also states that the “[d]isplacement along the y axis could be similarly obtained by applying the read-out gradient of the NAV echo along the y axis (Y-NAV) rather than along the x.” *Id* at pg. 257. In other words, Ehman et al. presents an alternate embodiment where the navigator echo is applied as the phase spatial-encoding gradient, G_y , is applied. *Id*. Accordingly, even in the alternate embodiment presented by Ehman et al., spatially-encoded non-imaging data is disclosed – not non-spatially-encoded non-imaging data.

Therefore, the Ehman et al. reference cited by Larson et al. clearly contradicts the Examiner’s statement that non-imaging data is equivalent to non-spatially encoded data. That is, as seen in the example cited by Larson et al., spatially-encoded MR non-imaging data is used for timing purposes and is not used in the final image. In other words, Larson et al. teaches the determination of motion based on spatially-encoded data – not based on non-spatially-encoded data.

Accordingly, Larson et al. does not teach, suggest, or disclose, either expressly or inherently, the determination of motion in the region-of-interest based on motion data that comprises non-spatially encoded MR data free of spatially-encoded MR_data, as set forth in claim 34.

The above-discussed clarification also applies to newly presented claim 44 and 48, where in each claim data that is not spatially encoded is used in a determination or assessment of motion. For example, claim 44 calls for, in part, the acquisition of central k-space MR data from a region-of-interest at a time other than during an application of frequency and phase encoding gradients. This central k-space MR data, according to claim 44, is then used to assess motion. As such, since this data is acquired when the spatial-encoding gradients, frequency and phase, are not

being applied, the central k-space MR data is not spatially encoded. Similarly, claim 48 sets forth non-spatially-encoded data used in determining motion.

It is further noted that Larson et al. does not teach, suggest, or disclose a determination of motion based on motion data comprised of non-spatially-encoded MR data free of spatially encoded data, as set forth in claim 34. In contrast, Larson et al. relies either wholly on imaging data, which is of course spatially encoded, to extract timing information therefrom or on “a combination of MR imaging data and additional non-imaging data.” *Larson et al.*, ¶20. However, as discussed above, the non-imaging data disclosed by Larson et al. is spatially encoded. *Id.* at ¶¶39-44; *See also Ehman et al.* As such, the imaging and non-imaging data disclosed by Larson et al. is spatially encoded and such data is used to determine motion. Even if, *arguendo*, it could be said that the Larson et al. non-imaging data is non-spatially-encoded, Larson et al. still teaches a determination of motion based on a combination of imaging and non-imaging data – not data free of spatially-encoded data. Accordingly, Larson et al. does not teach the determination of motion in the region-of-interest based on motion data that comprises a first set of non-spatially encoded MR data free of spatially-encoded MR data.

For substantially similar reasons, it is understood that Larson et al. does not teach a determination of motion independent of sampled MR imaging data, or the determination of motion based on MR motion data free of spatially-encoded MR data, as respectively set forth in claims 44 and 48.

Accordingly, Larson et al. does not teach, suggest, or disclose that which is called for in claims 34, 44, 48 and those claims depending therefrom.

Applicant also points out that the Examiner’s statement that slice tracking is conceptually equivalent to Larson et al.’s timing is inaccurate. *Office Action*, 09/13/2007, pg. 3, no. 10. Synchronization (timing) and slice tracking are different concepts. Synchronization, or timing determination, determines when a motion occurs. This timing information is then often used to gate acquisitions. That is, the timing information is often used to determine when acquisitions begin. However, slice tracking, as it is known in the art, is a technique used to position or reposition a slice in space so that it corresponds with a previous anatomical slice location. In other words, slice tracking is used to position a slice location in space, whereas timing/synchronization is used to position an acquisition in time. These are two very different concepts.

Next, Applicant points out that the Examiner ignored Applicant’s disqualification of Ho et al. as prior art. *See Advisory Action*, 05/30/2008. As stated in a prior response, *Response*,

11/13/2007, pg. 10, the Examiner rejected claim 28 under §103(a) as being unpatentable over Larson et al. in view of Ho et al. Ho et al. was published on November 20, 2003. The present application was filed on October 12, 2004. Since the publication date of Ho is less than one year before the filing date of the present application, Ho et al. qualifies as prior art under 35 U.S.C. §102(e). However, since the present application and Ho et al. were, at the time the invention was made, owned by and/or subject to an obligation of assignment to the same entity, Ho et al. cannot be cited in a rejection against the claimed invention under 35 U.S.C. §103(a). See MPEP §706.02(l). The Ho et al. application was assigned to GENERAL ELECTRIC COMPANY and recorded at Reel/Frame #016212/0534. The current application is also assigned to GENERAL ELECTRIC COMPANY and recorded at Reel/Frame #015570/0231. Despite Applicant's disqualification of Ho et al. as prior art, the Examiner did not withdraw the claim 28 rejection under §103(a) in the Advisory Action.

Further, Applicant again points out that the Examiner has made inaccurate, unsupported, and unsubstantiated statements with regard to the §103(a) rejection of cancelled claim 28. In regard to cancelled claim 28, the Examiner stated that "[t]he relative timing during the time interval when k-space origin data are acquired (whether before or after further spatial encoding gradients are applied) has no bearing on its motion compensation purpose. . . ." *Office Action*, 09/13/2007, pg. 13. The Examiner has proffered no support or substantiation for this statement. Applicant believes that one skilled in the art would not agree with the Examiner that relative timing during the time interval when k-space origin data are acquired has no bearing on its motion compensation purpose. Due to subject motion within a repetition time interval and signal decay over the repetition time interval, a k-space origin signal sampled early in the repetition time interval will differ from a k-space origin signal sampled later in the repetition time interval. Accordingly, if the Examiner maintains the assertion of the above-cited statement, Applicant requests that the Examiner show some sort of evidence in support of such.

Therefore, in light of at least the foregoing, Applicant respectfully believes that the present application is in condition for allowance. As a result, Applicant respectfully requests timely issuance of a Notice of Allowance for claims 34-54.

Applicant appreciates the Examiner's consideration of these Remarks and cordially invites the Examiner to call the undersigned, should the Examiner consider any matters unresolved.

Respectfully submitted,

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General Authorization and Extension of Time

The Commissioner is hereby authorized to charge any additional fees which may be required regarding this application under 37 C.F.R. §§ 1.16-1.17, or credit any overpayment, to Deposit Account No. 07-0845. Should no proper payment be enclosed herewith, as by credit card authorization being in the wrong amount, unsigned, post-dated, otherwise improper or informal or even entirely missing, the Commissioner is authorized to charge the unpaid amount to Deposit Account No. 07-0845. If any extensions of time are needed for timely acceptance of papers submitted herewith, Applicant hereby petitions for such extensions under 37 C.F.R. §1.136 and authorizes payment of any such extensions fees to Deposit Account No. 07-0845. Please consider this a general authorization to charge any fee that is due in this case, if not otherwise timely paid, to Deposit Account No. 07-0845.

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